Mathematicians often use $f(x)$ terminology for composite functions. For these radius and area functions, you can write

$r(x) = 8x$ $\quad$ x is the input for function r.

$a(x) = \pi x^2$ $\quad$ x is the input for function a.

The r and a become the *names* of the functions, and the $r(x)$ and $a(x)$ are the *values*, or *outputs*, of the functions. The x simply stands for the *input* of the function. You must keep in mind that the input for function r is the time and the input for function a is the radius.

Combining the symbols leads to this way of writing a composite function:

$$\text{area} = a(r(x))$$

The x is the input for the radius function, and the $r(x)$ is the input for the area function. The notation $a(r(x))$ is pronounced "a of r of x." Function r is called the *inside function* because it appears inside a pair of parentheses. Function a is called the *outside function*. Figure 1-4c shows this symbol and its meanings. The names parallel the terms *inside transformation* and *outside transformation* that you learned in the previous section.

Outside function $\quad$ Inside function

Input for function r

$$\text{area} = a(\underbrace{r(x)})$$

Input for function a = Output of function r

Figure 1-4c

The two function names are sometimes combined this way:

$a \circ r(x)$ $\quad$ or $\quad$ $(a \circ r)(x)$

The symbol $a \circ r$ is pronounced "a composition r." The parentheses in the expression $(a \circ r)$ indicate that $a \circ r$ is the name of the function.

Composite Functions from Graphs

Example 1 shows you how to find a value of the composite function $f(g(x))$ from graphs of the two functions f and g.

EXAMPLE 1 ➤ Functions f and g are graphed in Figure 1-4d. Find $f(g(30))$, showing on copies of the graphs how you found this value.

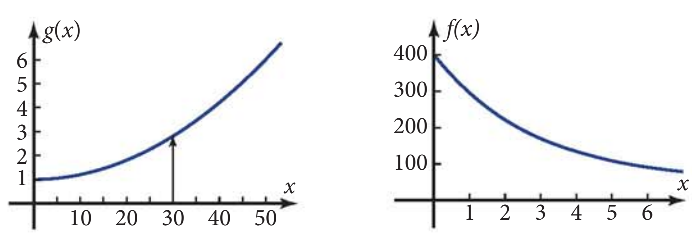

Figure 1-4d